WT-1316 (EX)

EXTRACTED VERSION

11643

OPERATION REDWING

Project 2.62a
Fallout Studies by Oceanographic Methods

Pacific Proving Grounds

May - July, 1956

Defense Atomic Support Agency

Sandia Base, Albuquerque, New Mexico

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NOTICE

This is an extract of **WT-1316, Operation REDWING, Project 2.62a,** which remains classified **Secret/ Restricted Data** as of this date.

Extract version prepared for:

Director
DEFENSE NUCLEAR AGENCY
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Approved for public release; distribution unlimited.

FOREWORD

This report presents the final results of one of the projects participating in the military-effect programs of Operation Redwing. Overall information about this and the other military-effect projects can be obtained from WT-1344, the "Summary Report of the Commander, Task Unit 3." This technical summary includes: (1) tables listing each detonation with its yield, type, environment, meteorological conditions, etc.; (2) maps showing shot locations; (3) discussions of results by programs; (4) summaries of objectives, procedures, results, etc., for all projects; and (5) a listing of project reports for the military-effect programs.

ABSTRACT

The first of five areas of study was the oceanography of the water within a 300-mile radius of Bikini Atoll prior to and during the operation. The objectives were to measure oceanographic parameters affecting the fallout pattern and to determine the radioactive background within the ocean. The results of this study have been presented as a separate report, WT–1349. A partial abstract is presented in Chapter 1 of this report.

The second study (Chapter 2) involved the determination of fallout by the use of oceanographic methods. In addition to the collection of samples for this and other projects, it was the objective of this survey to measure the intensity and extent of fallout, to convert this to equivalent land values, and to relate the in situ fallout distribution to the oceanographic parameters.

The results of the oceanographic fallout surveys show that: (1) Shot Cherokee (an air burst) produced no measurable fallout; (2) Shot Flathead (a water burst) produced fallout that mixed downward into the ocean water at a rate of 3.5 m/hr and attained an average penetration depth amounting to 75 percent of thermocline depth; (3) Shot Navajo (a water burst) produced fallout with a mixing rate of 2.3 m/hr and attained an average penetration depth of 75 percent of thermocline depth, and although Navajo had a total yield of [redacted] it produced an area of less than 150 mi^2 of hazardous dose rates; (4) Shot Tewa (a combination water-and-land burst) exhibited a mixing rate similar to Flathead (3.8 m/hr) and an average penetration depth similar to Flathead and Navajo (75 percent of thermocline depth); this 5-Mt, [redacted] produced hazardous dose rates over an area exceeding 2,000 mi^2; (5) Shot Zuni (a land burst) fallout mixed downward at 11 m/hr and reached an average penetration depth of 107 percent of thermocline depth; (6) dose rate in fallout resulting from nuclear detonations is directly proportional to the fraction of fission yield; and (7) the cube-root scaling laws are valid for fallout dose rates from nuclear detonations over the range from 0.4 to 5.0 Mt.

The third study (Chapter 3) concerned oceanographic and fallout measurements in the lagoon circulation for various wind conditions and, from this, predict the movement of radioactive water from a knowledge of the winds. The results of the lagoon oceanographic studies have been presented in WT–1349. The measurements show that the movement of radioactivity with the lagoon water corresponds to the observed current movements. These same measurements have been used in WT–1349 to develop a method of predicting the distribution of radioactivity within the lagoon from a knowledge of current directions and velocities.

The fourth interrelated field of work (Chapter 4) involved the installation and maintenance of anchored instrument stations in the deep ocean water. The results of this effort have such military and scientific implications that the complete procedure for installing these stations is included as an appendix.

The last study (Chapter 5) was a radiochemical examination of fallout in the marine biosphere. The results show the distribution of fallout material in the water, the air above the water, the sediments, and marine life. These studies were carried out in the lagoon as well as in the open ocean. Marine organisms selectively absorb such nonfission products as Mn^{54}, Co^{58}, Co^{60}, and Zn^{65}. Oceanic contamination was detected from the Eniwetok Proving Grounds to a latitude of 11 degrees south after the completion of the test series.

TABLE 2.11 SUMMARY OF AREAL EXTENT OF FALLOUT

	Zuni	Flathead	Navajo	Tewa
Total Yield, Mt	3.38			4.6
H + 1 Hour Dose Rate (r/hr)	Area (mi^2) Within Contour Lines			
1,000	—	—	25	450
500	—	—	55	1,050
300	—	—	80	1,550
100	750	—	310	3,500
50	1,720	—	950	5,850
30	4,000	90	1,350	11,500
10	7,600	2,100	3,300	> 29,000
5	10,800*	7,600	8,250*	—
3	> 16,500	10,800	11,600*	—
1	> 28,000	> 20,000	—	—
Two-day Accumulated Dose, Roentgens				
1,000	—	—	20	520
500	—	—	30	1,050
300	—	—	45	1,500
100	1,450	75	350	3,000
50	2,750	425	770	3,900
30	4,300	800	1,300	5,450
10	7,900	2,700	2,150	13,600
5	11,400*	5,400	3,100	> 22,000
3	> 15,700	9,500	4,650*	—
1	> 26,000	> 18,000	11,700*	—

* Contour lines that have been closed by estimation.

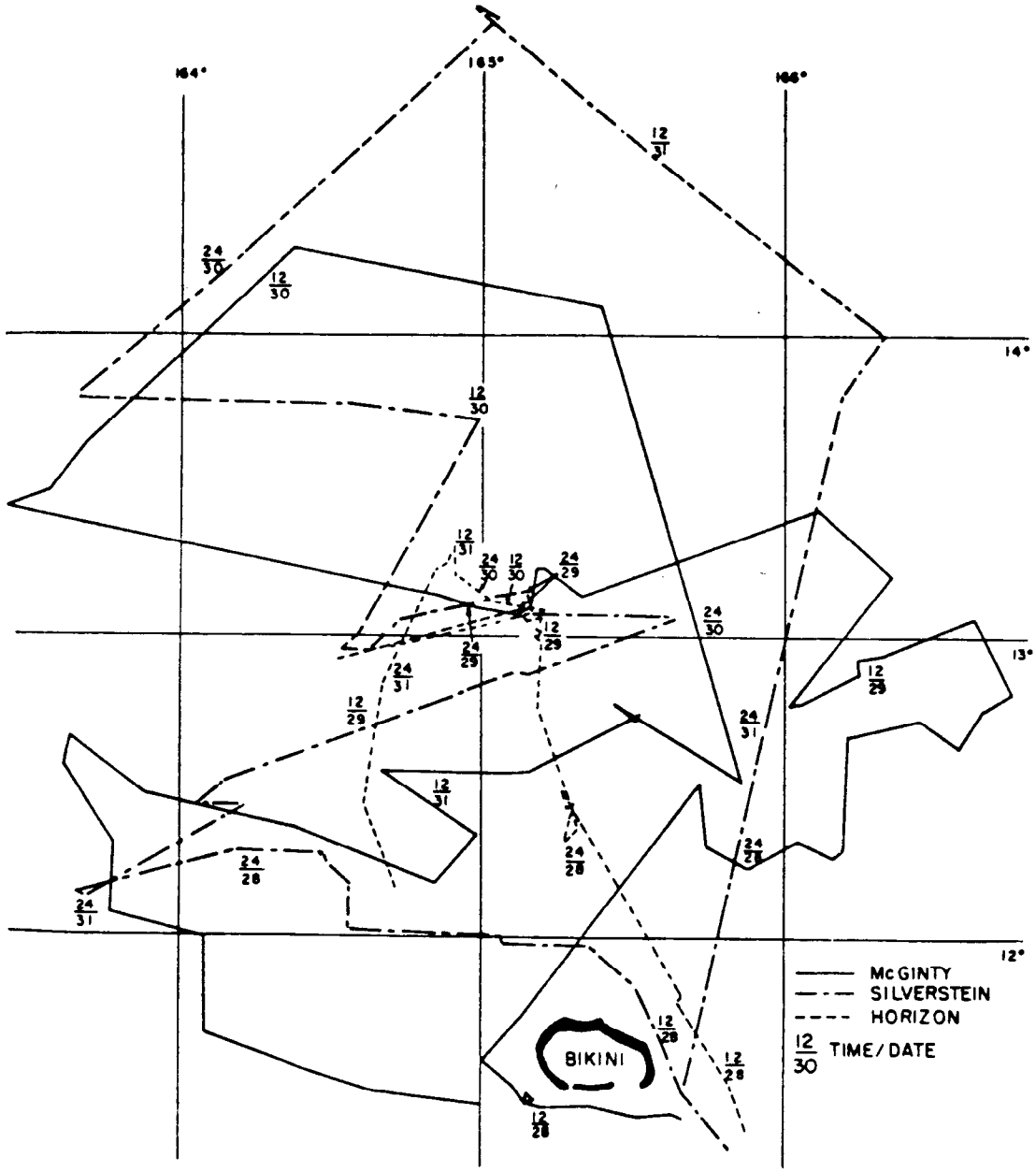

Figure 2.6 Tracks of survey ships for Shot Zuni.

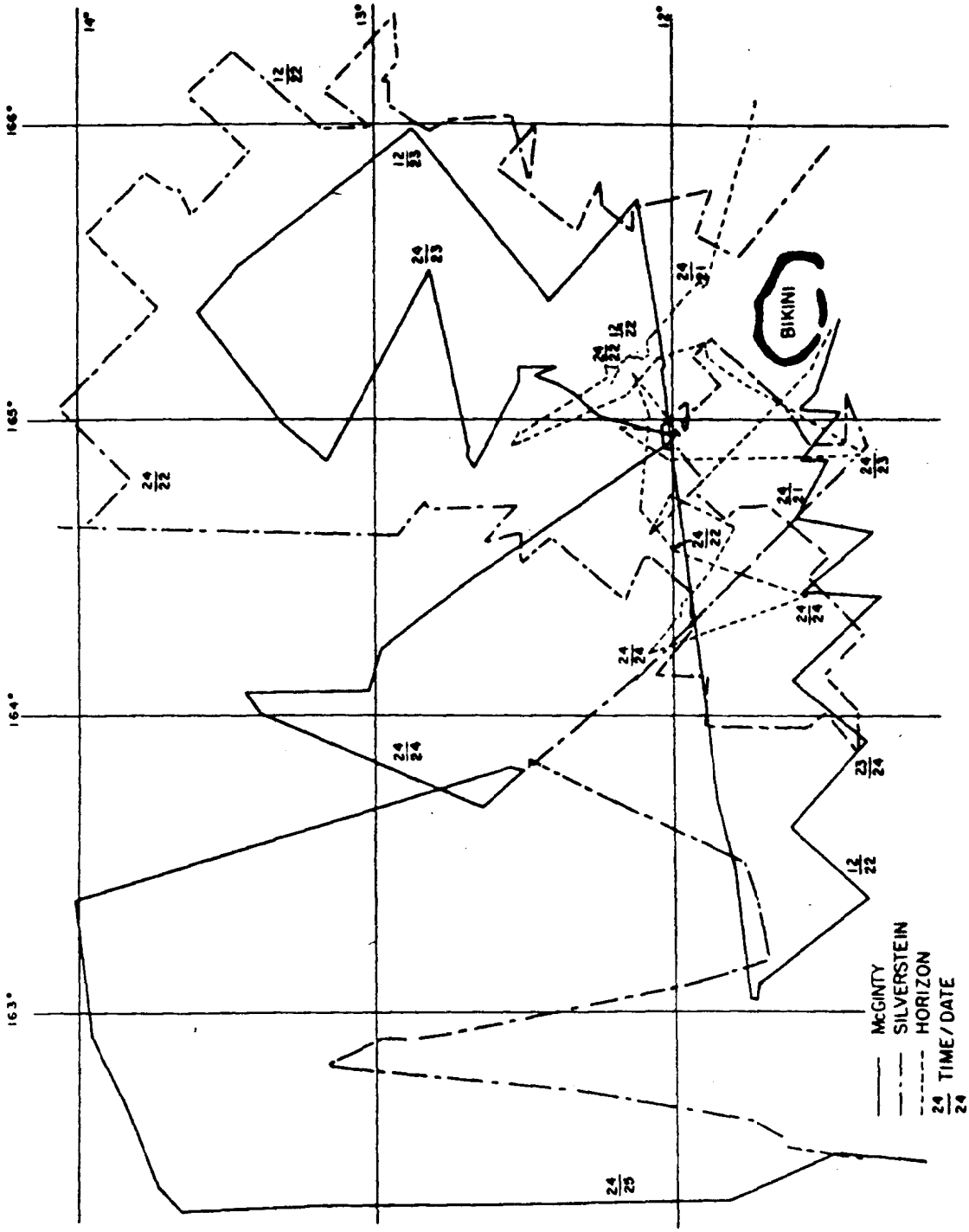

Figure 2.9 Tracks of survey ships for Shot Tewa.

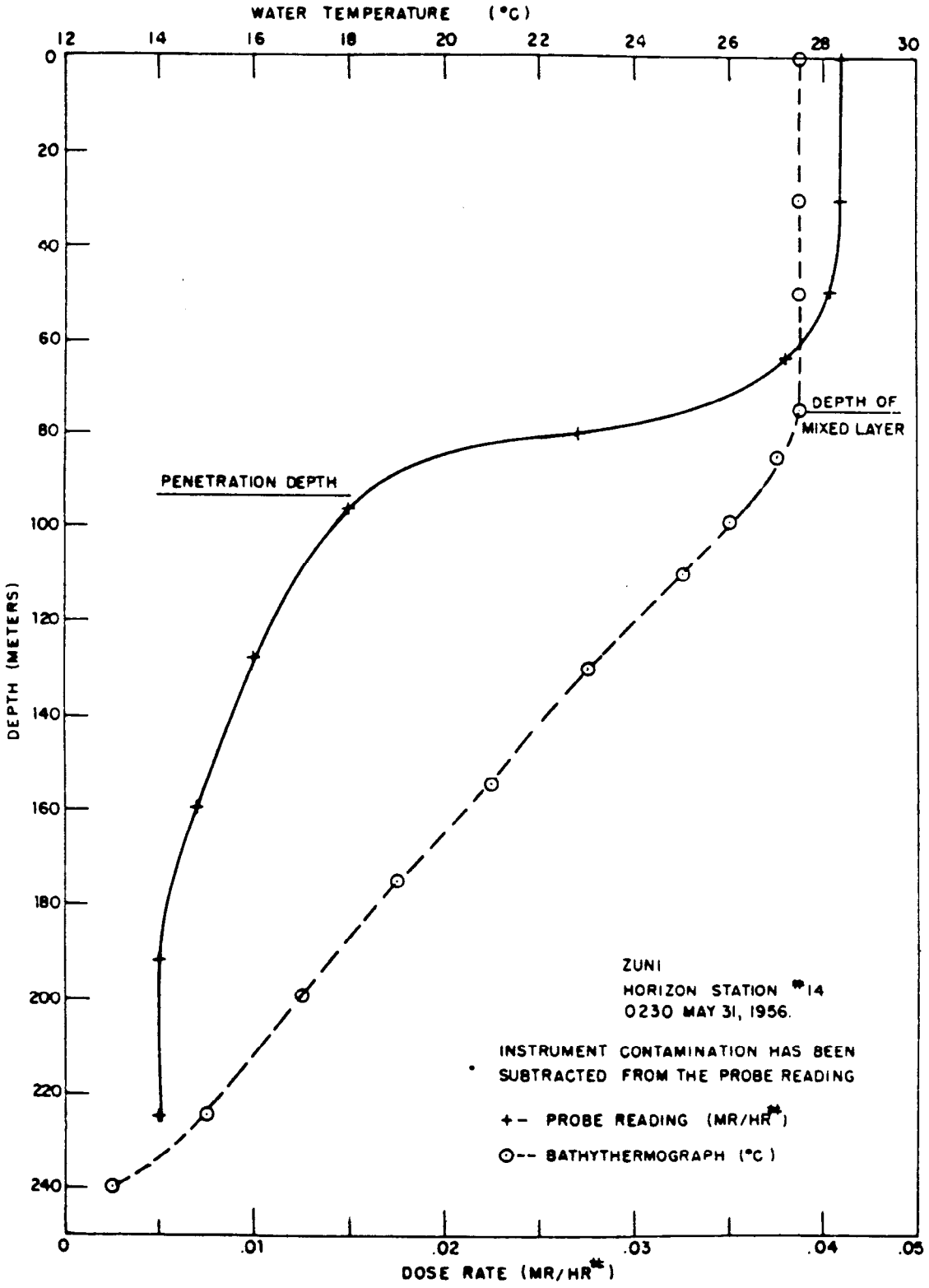

Figure 2.16 Comparison of dose rate and temperature versus depth, Shot Zuni.

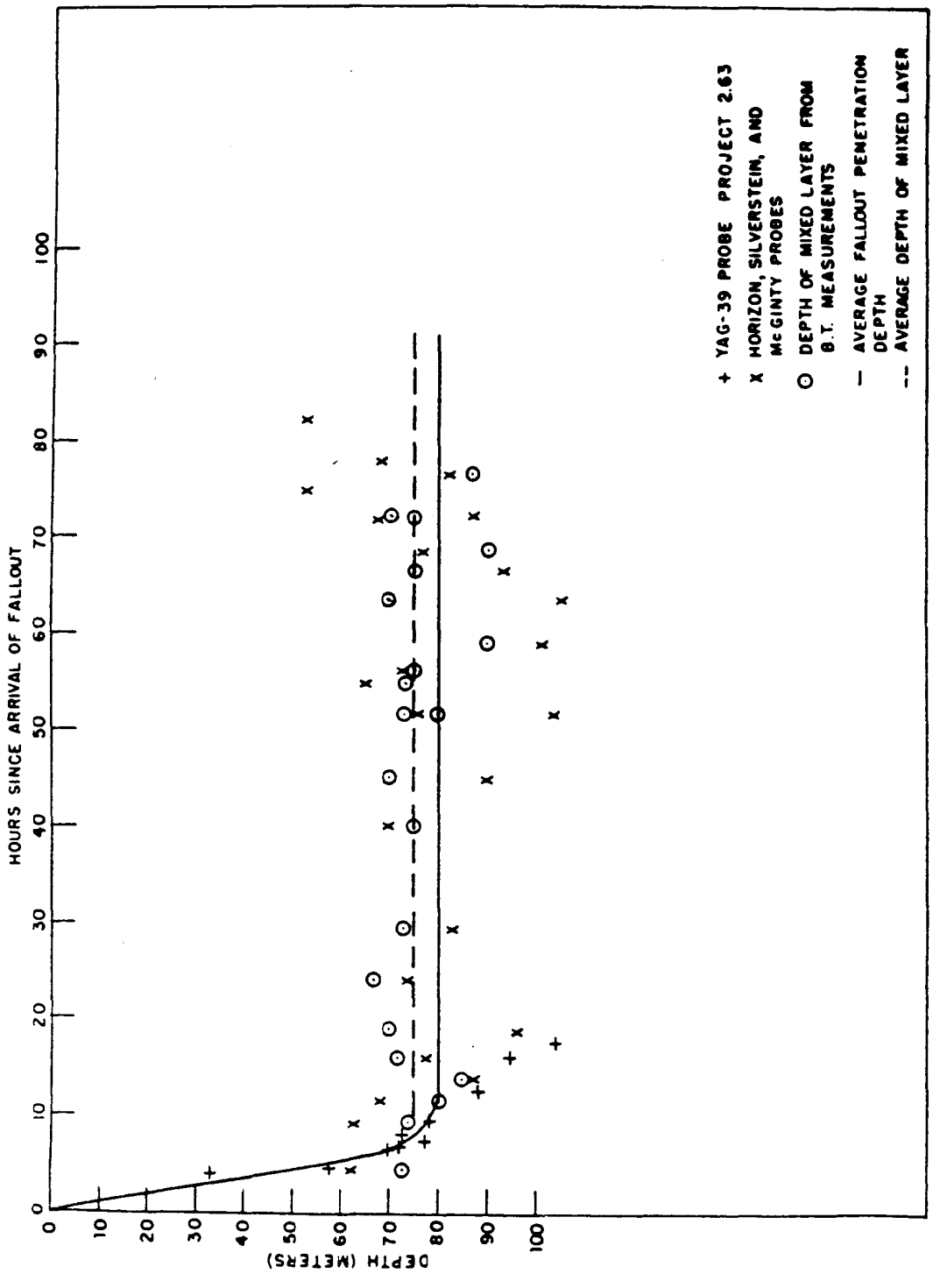

Figure 2.17 Probe measurements of fallout penetration depth, Shot Zuni.

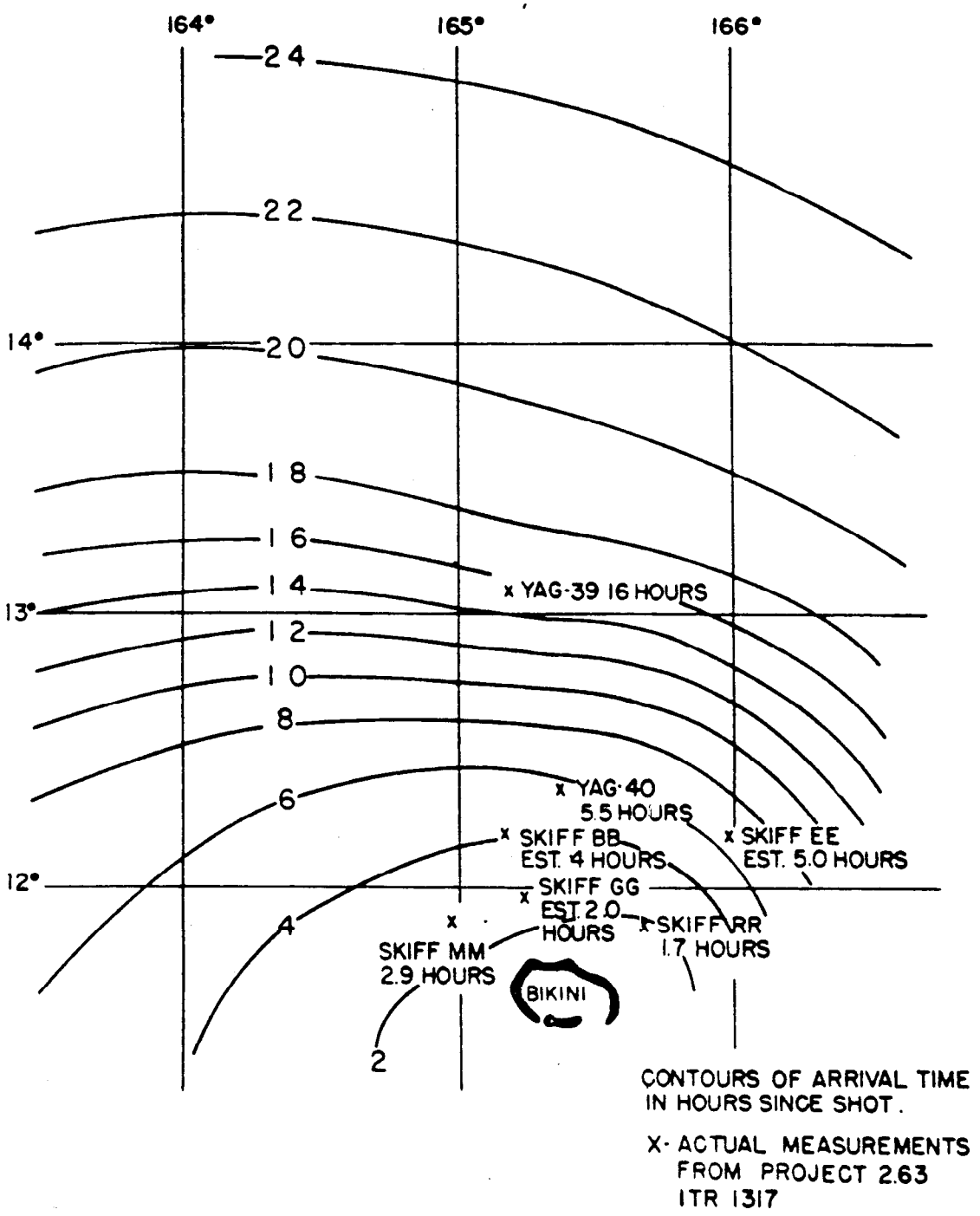

Figure 2.21 Estimated fallout time of arrival for Shot Zuni.

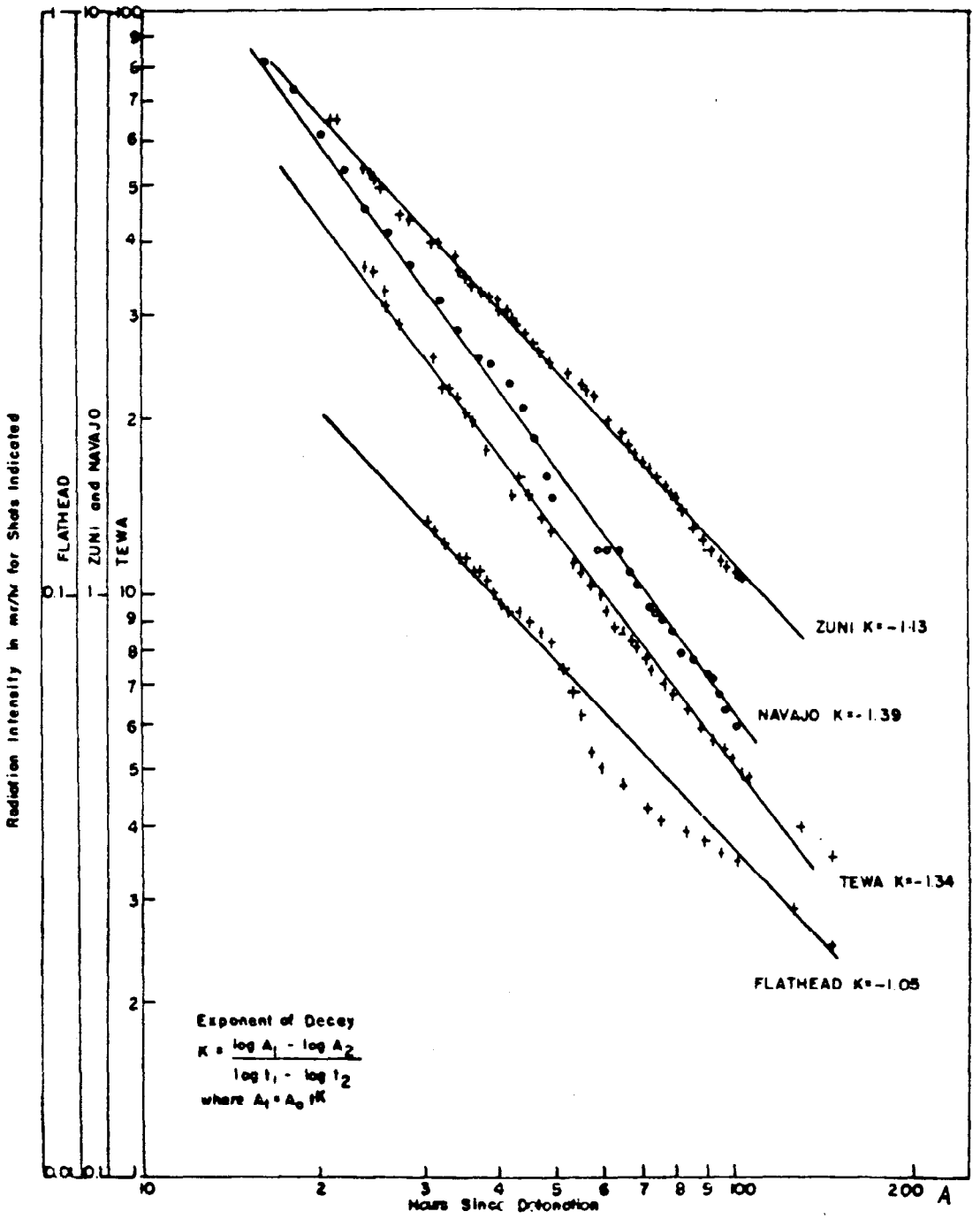

Figure 2.33 Exponent of decay as measured in decay tank of M/V Horizon.

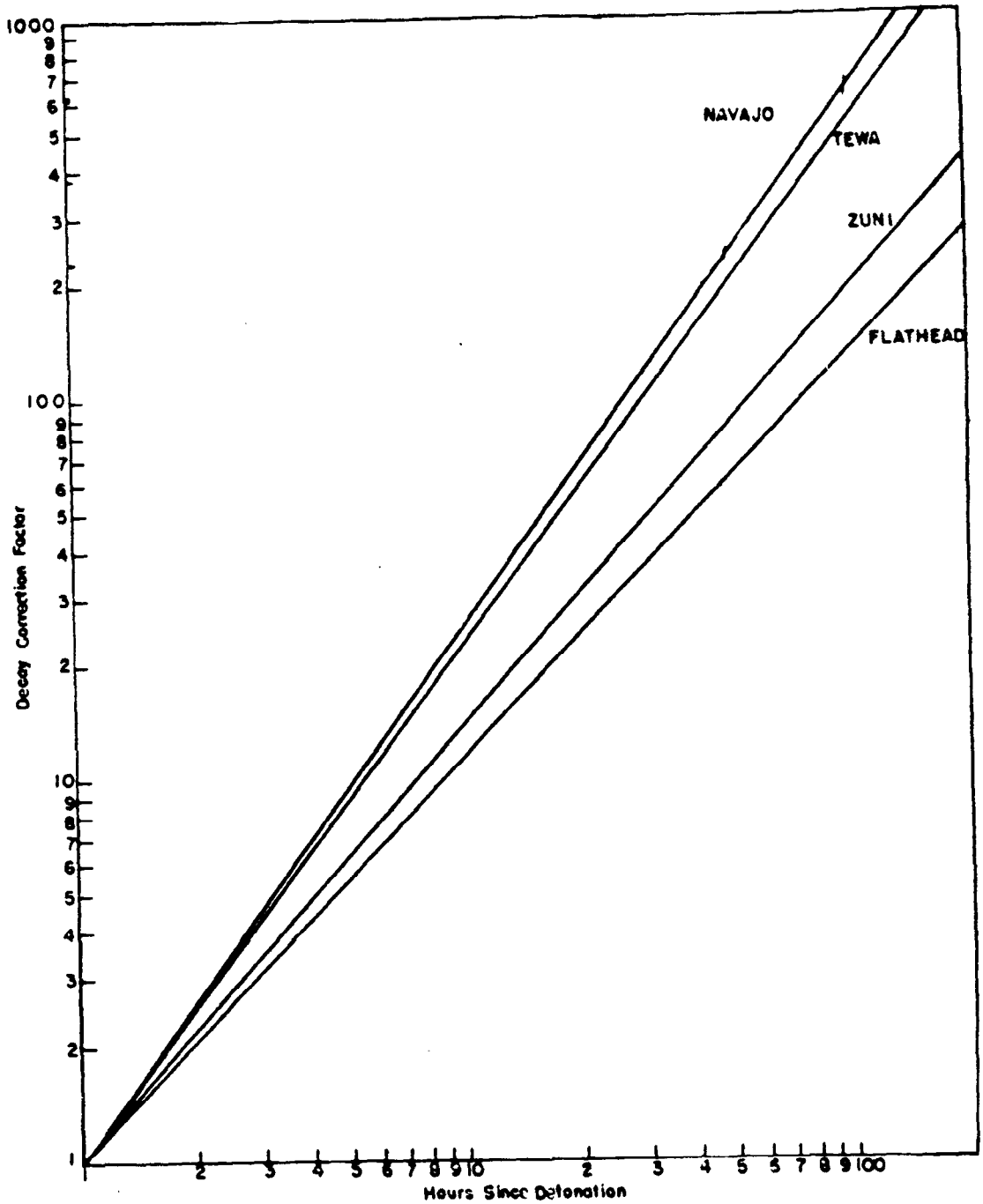

Figure 2.34 Decay correction factor for correcting dose rate values from time of measurement to H+1 hour.

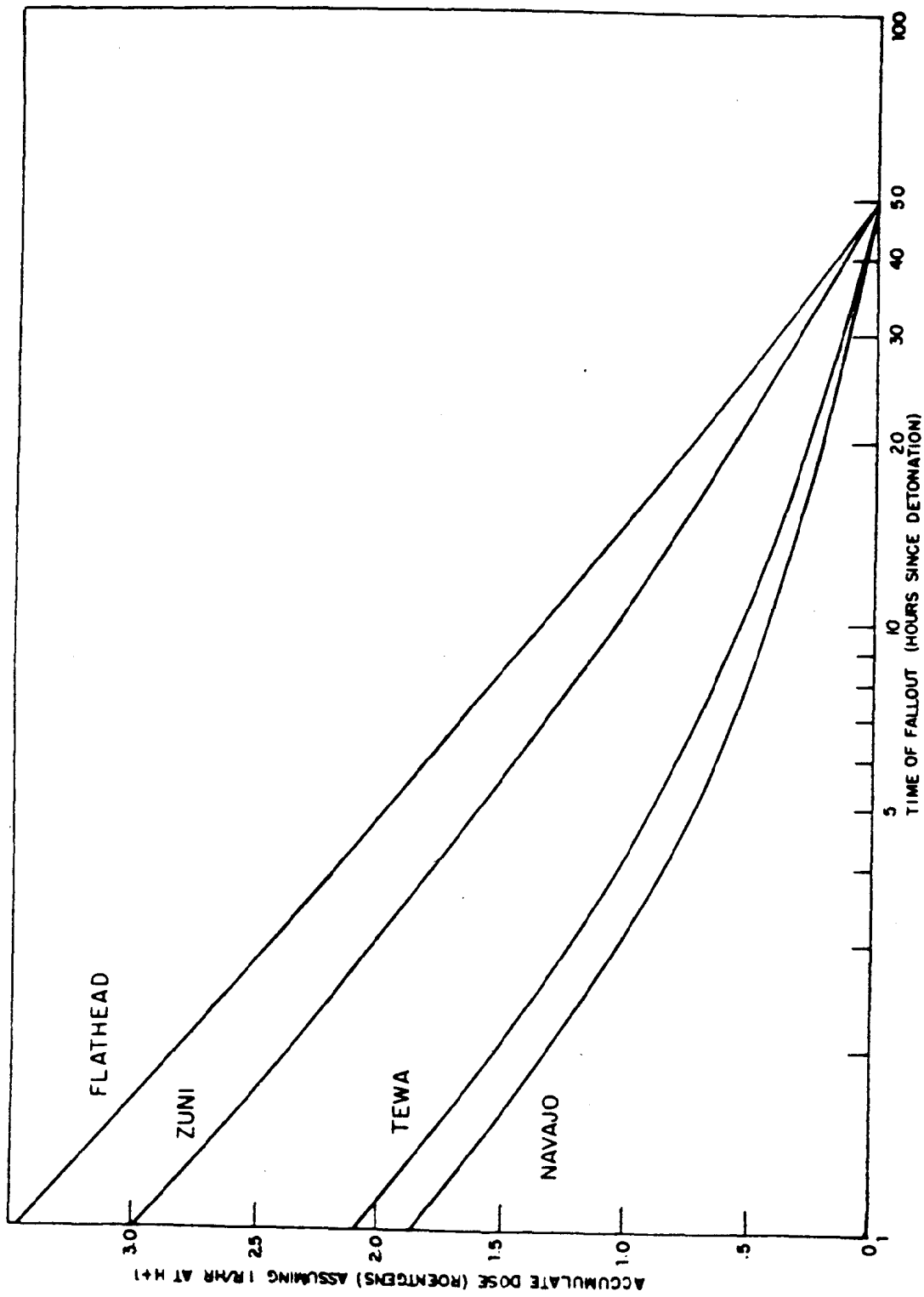

Figure 2.35 Factor for determining accumulated dose (time of arrival to H + 50) from dose rate at H + 1.

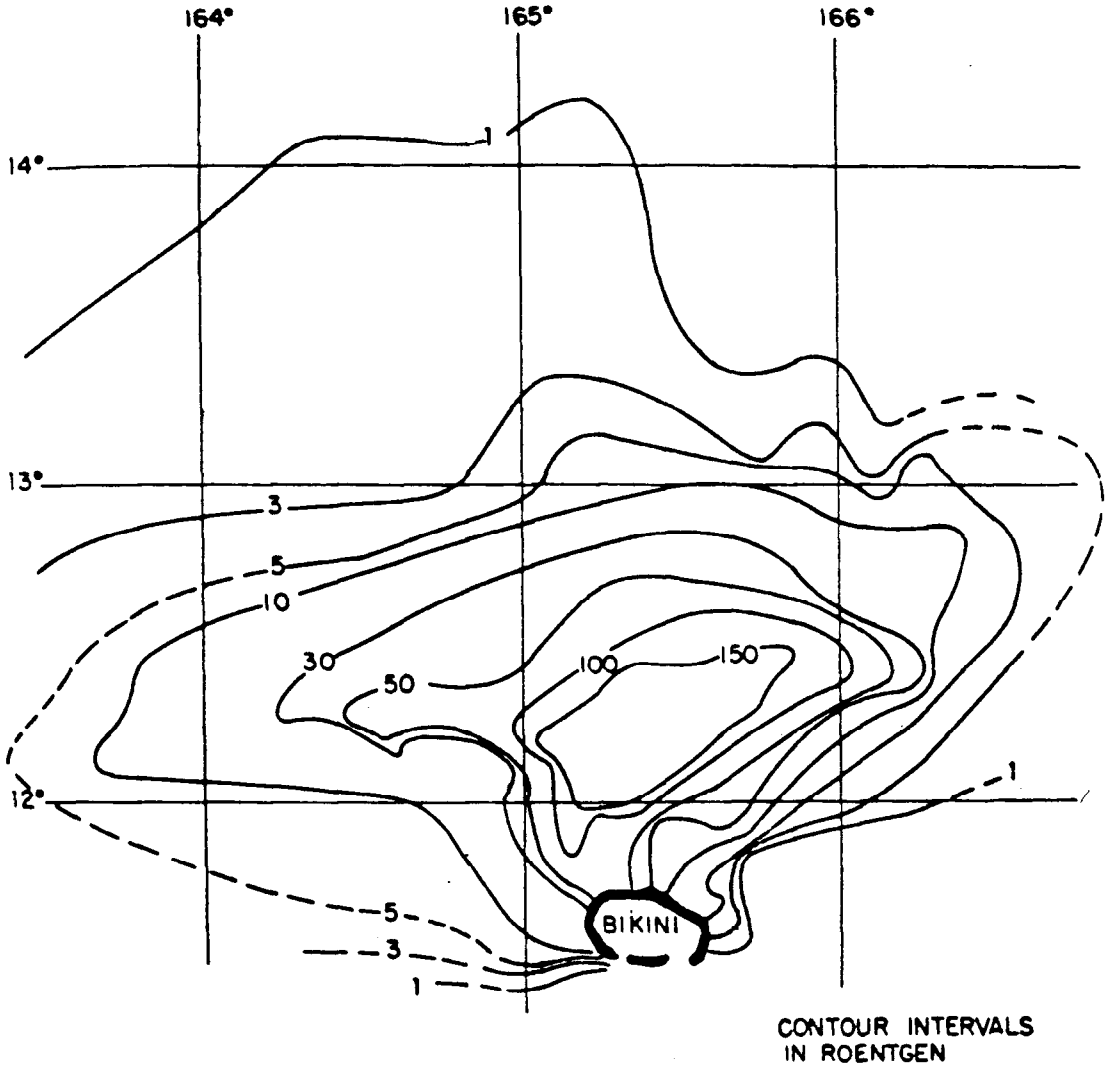

Figure 2.37 Accumulated dose (time of arrival to H+50), Shot Zuni.

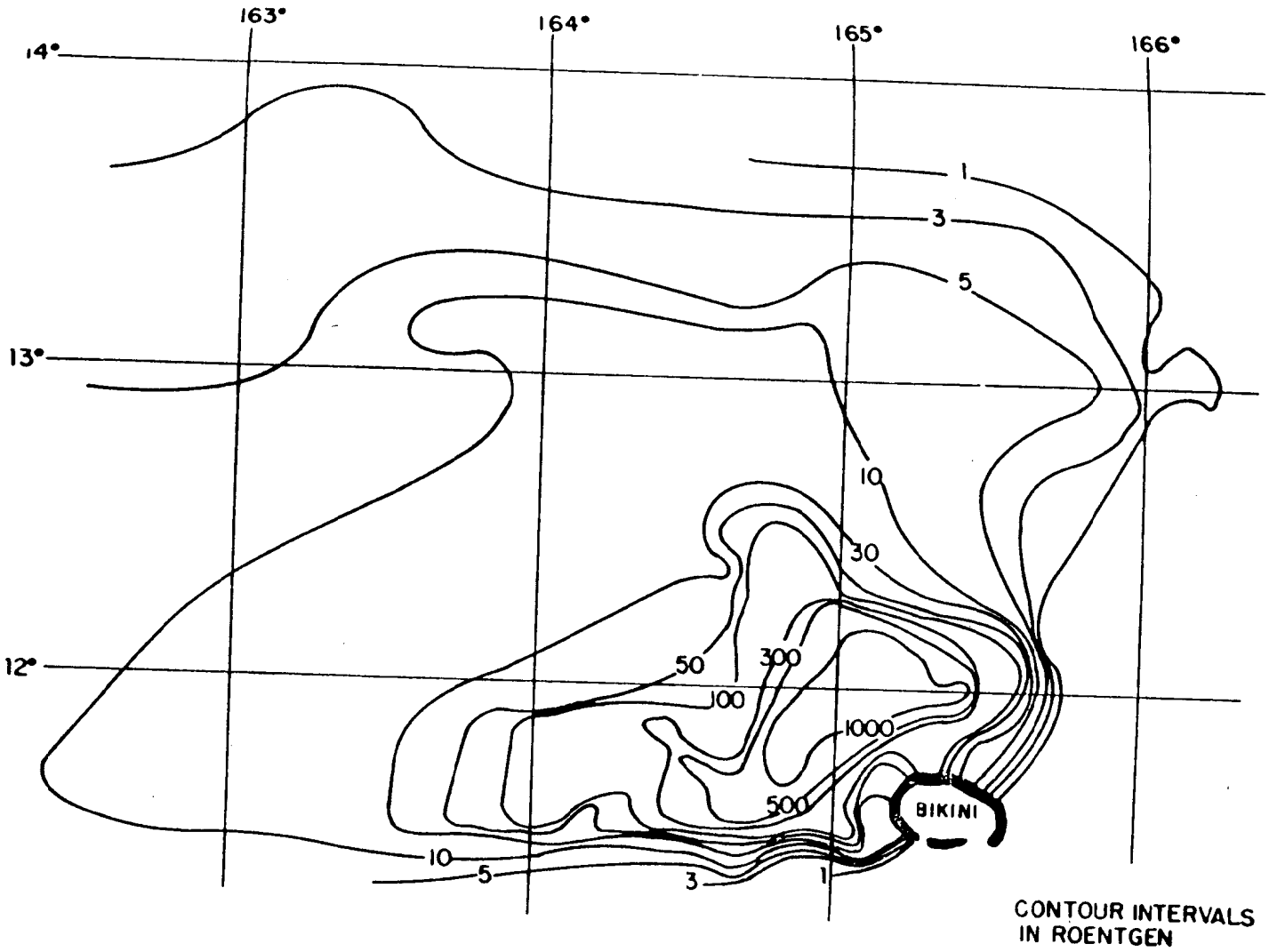

Figure 2.44 Accumulated dose (time of arrival to H+50), Shot Tewa.

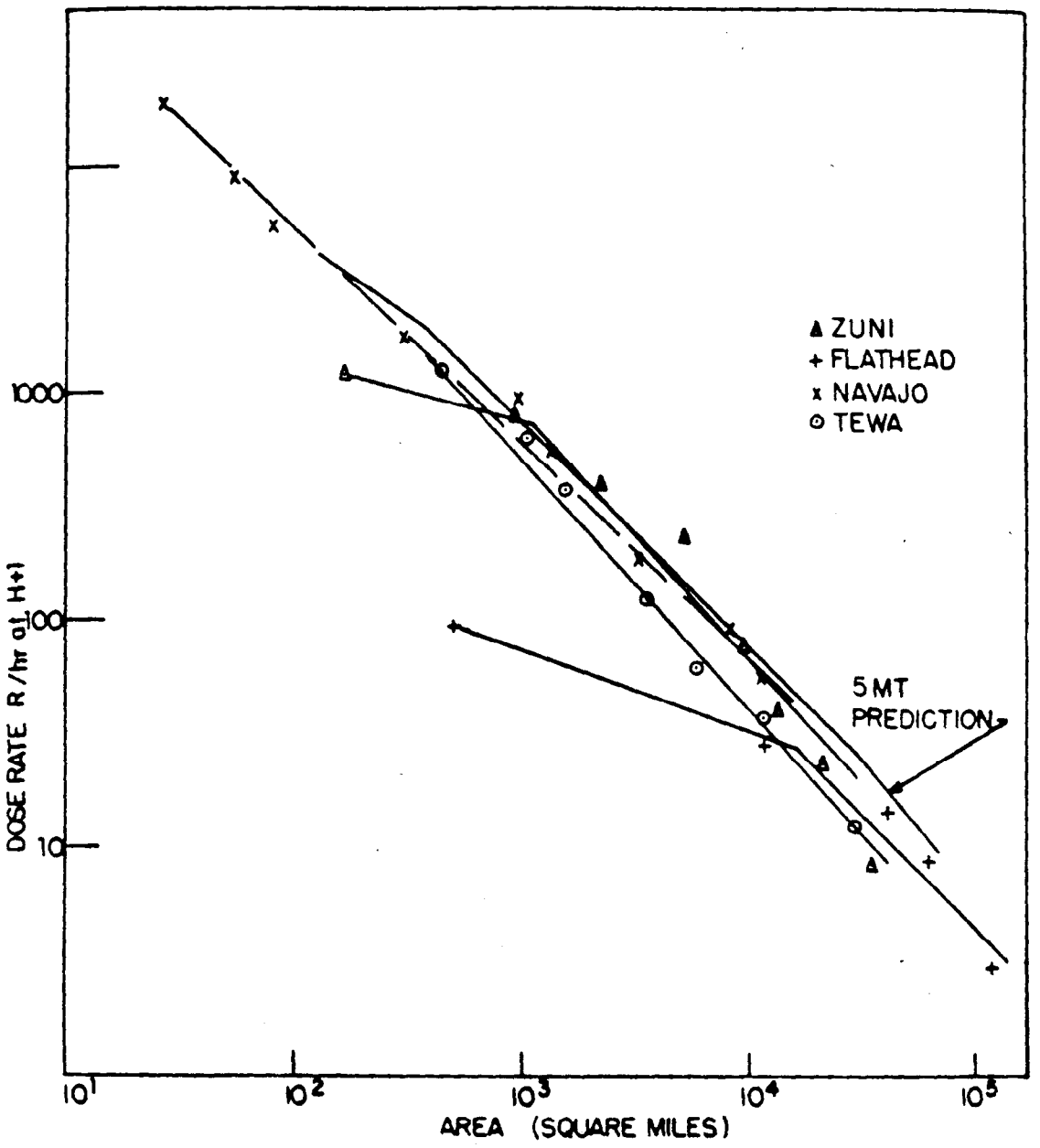

Figure 2.45 Areas of dose rate contours for Redwing shots normalized to 5 Mt 100 percent fission.